REMARKS

The present response is intended to be fully responsive to all points of objection and/or rejection raised by the Examiner and is believed to place the application in condition for allowance. Favorable reconsideration and allowance of the application is respectfully requested.

Applicants assert that the present invention is new, non-obvious and useful. Prompt consideration and allowance of the claims is respectfully requested.

Status of Claims

Claims **1, 5-18, 21-32, 36** and **38-40** are pending.

Claims **1, 5-18, 21-32, 36** and **38-40** have been rejected.

Claims **1, 9, 17, 25, 30,** and **32** have been amended in this submission. Applicants respectfully assert that the amendments to the claims add no new matter. It will be noted that these amended elements do not add new matter and do not require further search, as they are inserted from previously pending claims, now cancelled.

Claims **5, 8, 21, 24,** and **31** have been cancelled without prejudice or disclaimer.

Amendment After Final Office Action

Applicants recognize that the entry of amendments after final Office action is not a matter of right. However, the Examiner will readily recognize that the amendments merely serve to incorporate elements of now-cancelled dependent claims into the independent claims. Claim 1 is amended to include elements of claims 5 and 8; claim 17 is amended to include elements of claims 21 and 24; etc.

Applicants respectfully assert that the amendments place the application either in condition for allowance or in better form for appeal, and therefore, may be entered.

CLAIM REJECTIONS

35 U.S.C. § 102 Rejections

In the Office Action, the Examiner rejected claims 1, 5, 8, 10, 11, 13-18, 21, 24, 26-32, 36 and 38-40 under 35 U.S.C. § 102(e), as being anticipated by Lee (US Patent No. 7,365,722). Claims 5, 8, 21, 24, and 31 have been cancelled. With respect to the remaining claims, Applicants respectfully traverse the rejection for at least the below reasons.

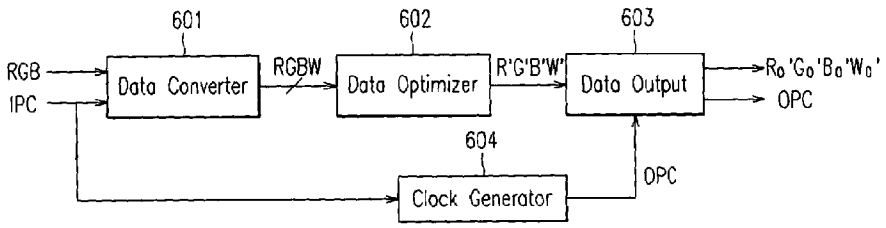
The Lee reference discloses:

> A four color liquid crystal display (LCD) including red, green, blue, and white pixels is provided. The LCD also includes a plurality of gate lines for transmitting gate signals to the pixels and a plurality of data lines for transmitting data signals to the pixels. The LCD further includes a gate driver supplying the gate signals to the gate lines, a data driver supplying the data voltages to the data lines, and an image signal modifier. The image signal modifier includes a data converter converting three-color image signals into four-color image signals, a data optimizer optimizing the four-color image signals from the data converter, a data output unit supplying the optimized image signals to the data driver in synchronization with a clock, and a clock generator generating the clock. The data driver operates in synchronization with the clock. (Abstract)

With respect to pending claim 1, the Examiner pointed to signal controller 600, image signal modifier 610, data converter 601, and data optimizer 602. Signal controller 600 includes image signal modifier 610, which converts the three-color image signals R, G and B into four-color image signals and processes and modifies the four-color image signals suitable for the operation of the panel assembly 300 on the basis of the input control signals and the input image signals R, G and B.

The image signal modifier includes a data converter 601 "for converting three-color image signals R, G and B into four-color image signals R, G, B and W," data optimizer 602 "for optimizing the four-color image signals R, G, B and W," as well as data output unit 603 for outputting the optimized image signals R', G', B' and W', and a clock generator. (Lee, col. 11, lines 40-43).

FIG.7



With respect to claim 1, the Examiner pointed to image signal modifier 610 as the conversion module, data converter 601 as the first converter, and data optimizer 602 as the second converter. The Examiner has also pointed to signal controller 600 as the controller.

Applicants have thoroughly studied the Lee reference, and traverse the rejection for at least the following reasons.

Data optimizer 602 does not satisfy every element of claim 1 with respect to the second converter. In particular, the second converter converts intermediate sub-pixel data into converted sub-pixel data "based on at least one display attribute related to said display device and image attributes related to said color image. . ." In order to find this element of the second converter in the data optimizer, the Examiner pointed to col. 10, lines 32-38 and lines 59-65, and col. 11 lines 42-43, reproduced below:

> The signal controller 600 is supplied with three-color image signals R, G and B and input control signals controlling the display thereof such as a vertical synchronization signal Vsync, a horizontal synchronization signal Hsync, a main clock MCLK, and a data enable signal DE, from an external graphic controller (not shown). The image signal modifier 610 of the signal controller 610 converts the three-color image signals R, G and B into four-color image signals and processes and modifies the four-color image signals suitable for the operation of the panel assembly 300 on the basis of the input control signals and the input image signals R, G and B. (Lee, col. 10, lines 28-39, emphasis added).
>
> * * *
>
> The data driver 500 receives a packet of the image data Ro', Go', Bo' and Wo' for a pixel row from the signal controller 600 and converts the image data Ro', Go', Bo' and Wo' into the analog data voltages selected from the gray voltages supplied from the gray voltage generator 800 in

> response to the data control signals CONT2 from the signal controller 600. (Lee, col. 10, lines 59-65).
>
> * * *
>
> An image signal modifier according to an embodiment of the present invention includes a data converter 601 for converting three-color image signals R, G and B into four-color image signals R, G, B and W, a data optimizer 602 for optimizing the four-color image signals R, G, B and W, a data output unit 603 for outputting the optimized image signals R', G', B' and W' in synchronization with a clock OPC, and a clock generator for generating the clock OPC. The output image signals from the data output unit 603 are denoted as Ro', Go', Bo' and Wo'. (Lee, col. 11, lines 38-48, emphasis added).

Nowhere in this portion (or elsewhere) does the Lee reference disclose that the data optimization of data optimizer 602 is "based on at least one display attribute related to said display device and image attributes related to said color image," as recited in claim 1.

As disclosed in the specification of the present application:

> [0026] It will be appreciated that the term "display attributes" as used herein may refer to one or more attributes of a color display device, for example, a configuration of one or more sub-pixel elements within an array of sub-pixel elements of the display, a configuration of one or more defective sub-pixel elements within the array, a brightness and/or color non-homogeneity of the display device, and/or any other objective, subjective or relative attribute, which may be related to the display device.
>
> [0027] It will be appreciated that the term "image attributes" as used herein may refer to one or more attributes related to at least part of a displayed color image, or a color image to be displayed, for example, a perceived bit-depth of pixels of at least part of the color image, a viewed smoothness of at least part of the color image, a brightness and/or color uniformity of at least part of the color image, a rendering scheme to be applied to at least part of the color image, and/or any other objective, subjective or relative attribute, which may be related to the color image.

The data optimizer 602 does not optimize data "based on at least one display attribute related to said display device and image attributes related to said color image," as recited in claim 1.

Second, signal controller 600 does not satisfy every element of claim 1 with respect to the controller. Claim 1 recites that the controller is "to control said conversion module to convert said image data into said converted sub-pixel data based on said one or more display-attributes and said one or more image-attributes." This relationship between the controller and the conversion module is shown generally in the structure of Fig. 3 of the present application:

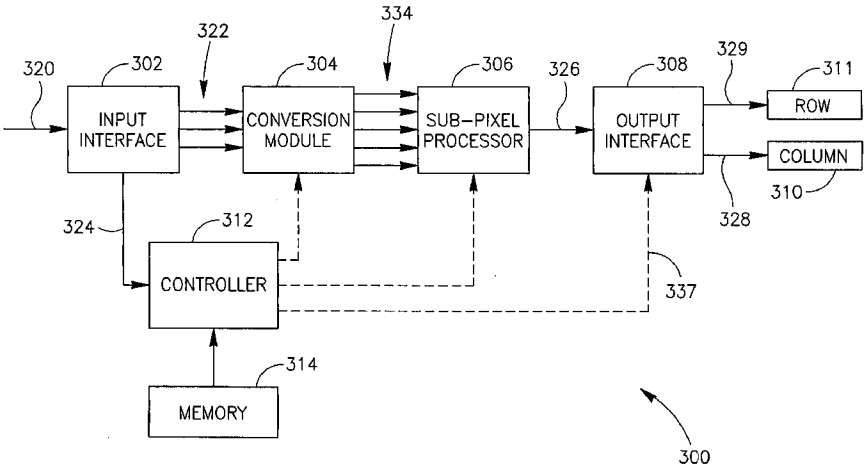


FIG.3

As described in the specification of the present application,

> [0048] According to exemplary embodiments of the invention, module 300 may further include a controller 312 to control conversion module 304, sub-pixel processing module 306 and/or output interface 308, e.g., based on values of one or more of signals 324 and/or at least one of the display attributes and/or image attributes, as described below. . . (emphasis added).

It will be noted that the controller provides a control input (dashed arrow underneath sub-pixel processor 306) to the second converter separate and distinct from the intermediate sub-pixel data 334. Specific examples of the controller controlling the second converter may be found throughout the application. For example, Fig. 9 illustrates one implementation of the controller:

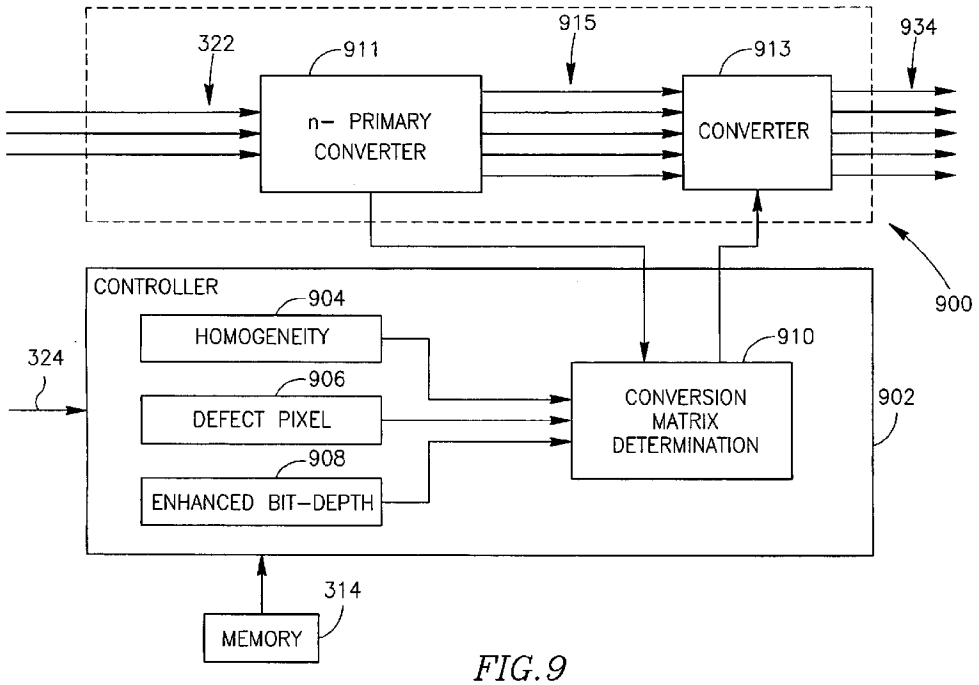


FIG. 9

In the above figure, controller 902 has a very specific control relationship to second converter 913:

> [0100] Module 900 may also include a second converter 913 able to convert the intermediate sub-pixel data of signals 915 into converted sub-pixel data signals 934. According to some exemplary embodiments of the invention, converter 913 may be able to perform a matrix multiplication of the intermediate sub-pixel data of signals 915 with a conversion matrix, denoted M. According to exemplary embodiments of the invention, one or more values of the conversion matrix M may be determined by a controller 902, e.g., based on signals 324, and/or one or more of the display attributes and image attributes, as described below.
>
> [0101] According to some exemplary embodiments of the invention, controller 902 may include a homogeneity-correction module 904, a defect pixel correction module 906, an enhanced bit-depth module 908, and a matrix determination module 910. Modules 904, 906 and/or 908 may be implemented using any suitable hardware, software or combination thereof.

Again, the controller 910 provides control input to the second converter 913 separate and distinct from the intermediate sub-pixel data 915. Thus, the controller may vary the

actual conversion parameters upon which second controller converts intermediate sub-pixel data into converted sub-pixel data.

However, in the Lee reference, signal controller 600 does no such thing with respect to data optimizer 602. The only input to data optimizer 602 that is shown (e.g., in Fig. 7) or described is the RGBW data. The Examiner pointed to col. 10 lines 23-45, part of which was reproduced above. Applicants have carefully reviewed this portion of the Lee reference, and have found no mention of the controller 600 controlling data optimizer 602 to convert said image data into said converted sub-pixel data based on said one or more display-attributes and said one or more image-attributes, as recited in claim 1.

In order to further highlight this operational relationship between controller and second converter, Applicants have amended the claims herein. For example, claim 1 recites that the controller is "to control said conversion module to convert said image data into said converted sub-pixel data based on said one or more display-attributes and said one or more image-attributes, wherein said controller is able to determine one or more values of said at least one conversion matrix based on at least one display attribute and at least one image attribute, and to provide said values of said at least one conversion matrix to said second converter."

Applicants note that newly amended elements of claim 1 are included from now-cancelled claims 5 and 8, which the Examiner rejected under the Lee reference. Applicants traverse the rejection for the following reasons.

The Examiner stated (with respect to now-cancelled claim 5) that the Lee reference discloses that the second converter is able to convert said intermediate sub-pixel data using at least one conversion matrix, said at least one conversion matrix based on at least one of said display attributes and said image attributes based on Lee, col. 12, lines 3-50.

Likewise, the Examiner stated (with respect to now-cancelled claim 8) that the Lee reference discloses that the controller is able to determine one or more values of said conversion matrix based on a combination of said one or more display attributes and said one or more image attributes based on Lee, col. 12, lines 3-50.

Applicants have thoroughly studied this portion of the Lee reference, and respectfully disagree with the Examiner. Lee states that the "data optimizer 602 selects an optimal set among the plurality of sets of four-color image data R, G, B and W considering the characteristics of the LCD such as resolution, power consumption, visibility, etc."

First, the Lee reference discloses use of a minimum function, and does not anywhere disclose use of a conversion matrix.

Second, nowhere does the Lee reference disclose that determination of the values is performed by the controller 600 and provided to the data optimizer 602.

Third, the listed attributes (resolution, power consumption, visibility, etc.) are common to the entire class of devices, e.g., all displays of a particular make and model, and they do not change over time. These are not display attributes "related to said display device," as recited. This is the reason that these values are not in matrix form, nor are they provided to the data optimizer – they are pre-programmed. In contrast, embodiments of the present invention are able to compensate on a dynamically varying basis for changing attributes of the display.

Fourth, nowhere in the Lee reference is there disclosed a variation in the conversion process based on different image attributes. In contrast, claim 1 recites that the controller is able to determine one or more values of the conversion matrix based on at least one image attribute related to the color image. In contrast, embodiments of the present invention are able to compensate on a dynamically varying basis for changing attributes of the color image being displayed.

Accordingly, claims 1, 10, 11, 13-18, 26-30, 32, 36 and 38-40 are allowable over the Lee reference.

Applicants further wish to point out certain dependent claims that recite claim elements that are independently allowable over the Lee reference.

As mentioned above, the display-attributes may be attributes of the particular display device, rather than merely features of all such displays. Accordingly, claim 13 as amended recites that "said one or more display-attributes comprise at least one attribute selected from

the group consisting of a configuration of one or more defective sub-pixel elements within said array, a brightness non-homogeneity of said display device, and a color non-homogeneity of said display device." The Examiner has pointed to Lee, col. 6 lines 19-23, reproduced below.

> Although the sequence of the pixels in a pixel row can be altered, it is preferable that the green pixels GP are far from the white pixels WP since the white pixels WP and the green pixels GP has transmittance higher than the red pixels RP and the blue pixels BP.

However, this portion does not relate to the display attributes, or to a controller determining values of a conversion matrix based on such display attributes, or a second converter converting intermediate sub-pixel data into converted sub-pixel data based on such conversion matrix. Lee certainly does not disclose a device-specific display attribute selected from "a configuration of one or more defective sub-pixel elements within said array, a brightness non-homogeneity of said display device, and a color non-homogeneity of said display device," as recited in claim 13.

Accordingly, claim 13 is allowable over the Lee reference. Claims 28 and 38 are allowable for similar reasons.

The image-attributes may be attributes of the particular image being displayed, rather than merely features of any image. Claim 14 recites that "said one or more image-attributes comprise one or more attributes selected from the group consisting of a perceived bit-depth of pixels of at least part of said image, a viewed smoothness of at least part of said image, a brightness uniformity of at least part of said image, a color uniformity of at least part of said image, and a rendering scheme to be applied to at least part of said image." The Examiner has pointed to the same portion of the Lee reference as called out above with respect to claim 13.

It is unclear how the attributes described in the same paragraph are both display attributes and image attributes(!) In any event, this portion of the Lee reference certainly does not relate to image attributes, or to a controller determining values of a conversion matrix based on such image attributes, or a second converter converting intermediate sub-

pixel data into converted sub-pixel data based on such conversion matrix. Lee does not disclose an image-specific image attribute selected from "a perceived bit-depth of pixels of at least part of said image, a viewed smoothness of at least part of said image, a brightness uniformity of at least part of said image, a color uniformity of at least part of said image, and a rendering scheme to be applied to at least part of said image," as recited in claim 14.

Accordingly, claim 14 is allowable over the Lee reference. Claims 29 and 39 are allowable for similar reasons.

35 U.S.C. § 103 Rejections

In the Office Action, the Examiner rejected claims 6, 7, 12, 22, and 23 under 35 U.S.C. § 103(a), as being unpatentable over Lee (US Patent No. 7,365,722) in view of Kumada et al. (US Patent No. 5,563,725).

In the Office Action, the Examiner rejected claims 9 and 25 under 35 U.S.C. § 103(a), as being unpatentable over Lee (US Patent No. 7,365,722) in view of Inoue (US Patent No. 5,896,178).

Neither of the Kumada and Inoue references rectify the deficiencies of the Lee reference, discussed hereinabove. Accordingly, the rejected dependent claims are allowable, at least for depending from allowable base claims.

In view of the foregoing amendments and remarks, Applicants assert that the pending claims are allowable. Their favorable reconsideration and allowance is respectfully requested.

Should the Examiner have any question or comment as to the form, content or entry of this Amendment, the Examiner is requested to contact the undersigned at the telephone number below. Similarly, if there are any further issues yet to be resolved to advance the prosecution of this application to issue, the Examiner is requested to telephone the undersigned counsel.

Please charge any fees associated with this paper to deposit account No. 50-3355.

Respectfully submitted,

/Guy Yonay/
Guy Yonay
Attorney/Agent for Applicants
Registration No. 52,388

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Pearl Cohen Zedek Latzer, LLP
1500 Broadway, 12th Floor
New York, New York 10036
Tel: (646) 878-0800
Fax: (646) 878-0801